REPORT DOCUMENTATION PAGE

Form Approved
OMB NO. 0704-0188

1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	05/01/03	Final report (5/1/01-7/31/02)

4. TITLE AND SUBTITLE

Development of Artificial Y-type Hexaferrites

5. FUNDING NUMBERS

DAAD 19-01-1-0583

6. AUTHOR(S)

C. Vittoria

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Northeastern University,
360 Huntington Ave. Boston, MA, 02115

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U. S. Army Research Office
P.O. Box 12211
Research Triangle Park, NC 27709-2211

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

41490.1-MS

11. SUPPLEMENTARY NOTES

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.

12 a. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

12 b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

We have developed a technique to orient particles of Y-type hexaferrite in which the c-axis of the particles are oriented perpendicular to a plane . As such, that plane becomes necessarily the easy plane of magnetization. For microwave device application the easy plane of magnetization is chosen as the plane to deposit a metallic microstrip and related circuit patterns. The technique entails the rotation of an external magnetic field in the easy plane, as the particles are pressed into a disc shape. We have succeeded on the orientation of particles of $Ba_2MnZnFe_{12}O_{22}$ in an easy plane of magnetization which exhibited the following properties: $4\pi Ms$=2300 Oe, Ha = 9500Oe , and Hc = 60Oe ,where $4\pi Ms$ is the saturation magnetization, Ha the uniaxial anisotropy field and Hc the coercive field. The coercive field and remanence can be varied by refiring the oriented particles . Maximum remanence of 27.5 % was obtained for refiring temperature of 1000 C . Much higher remanence is possible for thin film plane structure, where the aspect ratio exceeding 1000. These results imply that it is possible to orient the saturation magnetization in any direction within the plane of a device and the effective magnetization can be as high as 11800 Oe. The microwave properties indicate that the ferrimagnetic resonance linewidth at 27 GHz is 350 Oe and the g-factor approximately equal to 2, see fig .1. In fig.2 the vibrating sample magnetization (VSM) measurements for ZnMnY-type are shown for the external field applied parallel and perpendicular to easy plane of magnetization. We have also been working on Co2Y-type, our experiments show $4\pi Ms$=2.2kOe, Ha=42 kOe and linewidth around 2000Oe at 38 Ghz. Potential microwave applications are fabrication of IC circuits and microwave ferrite devices.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Hexaferrite, Orientation, and Ceramic.	1
	16. PRICE CODE

17. SECURITY CLASSIFICATION OR REPORT	18. SECURITY CLASSIFICATION ON THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

NSN 7540-01-280-550

Standard Form 298 (Rev.2-89)
Prescribed by ANSI Std. 239-18
298-102

20030509 071

Oriented Y-type Hexaferrites for ferrite devices

M. Obol, X. Zuo, T. Sakai and C. Vittoria . Northeastern University,Boston,MA 02115

We have developed a technique to orient particles of Y-type hexaferrite in which the c-axis of the particles are oriented perpendicular to a plane . As such, that plane becomes necessarily the easy plane of magnetization. For microwave device application the easy plane of magnetization is chosen as the plane to deposit a metallic microstrip and related circuit patterns. The technique entails the rotation of an external magnetic field in the easy plane, as the particles are pressed into a disc shape. We have succeeded on the orientation of particles of $Ba_2MnZnFe_{12}O_{22}$ in an easy plane of magnetization which exhibited the following properties: $4\pi Ms$=2300 Oe, Ha = 9500Oe , and Hc = 60Oe ,where $4\pi Ms$ is the saturation magnetization, Ha the uniaxial anisotropy field and Hc the coercive field. The coercive field and remanence can be varied by refiring the oriented particles . Maximum remanence of 27.5 % was obtained for refiring temperature of 1000 C . Much higher remanence is possible for thin film plane structure, where the aspect ratio exceeding 1000. These results imply that it is possible to orient the saturation magnetization in any direction within the plane of a device and the effective magnetization can be as high as 11800 Oe. The microwave properties indicate that the ferrimagnetic resonance linewidth at 27 GHz is 350 Oe and the g-factor approximately equal to 2, see fig .1. In fig.2 the vibrating sample magnetization (VSM) measurements for ZnMnY-type are shown for the external field applied parallel and perpendicular to easy plane of magnetization. We have also been working on Co2Y-type, ours experiment shows $4\pi Ms$=2.2kOe, Ha=42 kOe and linewidth around 2000Oe at 38 Ghz. Potential microwave applications are in the fabrication of IC circuits and microwave ferrite devices.

FMR data

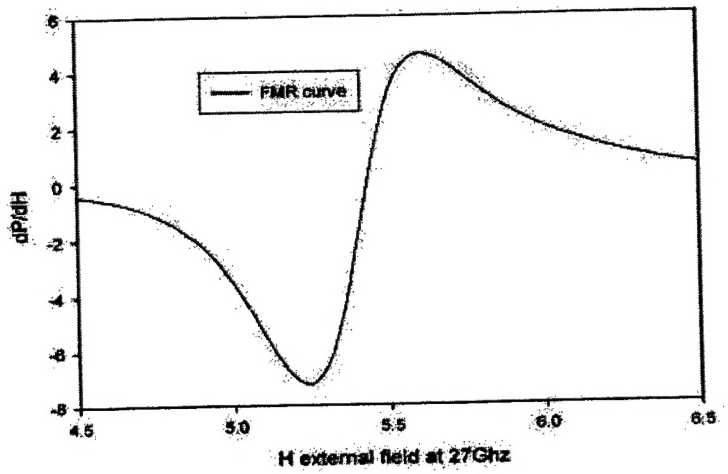

Fig.1

VSM data

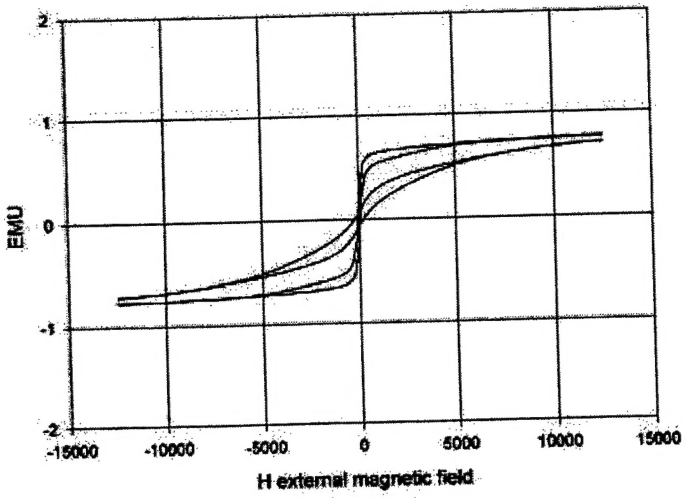

Fig.2